

Sawyer Passway Substation

Final Recommendation

Acceptance or Cancellation of Transformer Deliveries

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Contents (links)

[Recommendations to Address Near-Term Needs](#)

[FG&E Distribution System Load Study - 2000 through 2002 \(P. Krell Memo\)](#)

[Business Development Electric Load Prospect List Dated July 31, 2000](#)

[FG&E Substation Transformer Plan, Discussion of Alternatives](#)

[FG&E Substation Transformer Plan, Detailed Cost Estimates](#)



FG&E Power Transformer Requirements Recommendations to Address Near-Term Needs

Executive Summary

Engineering has conducted a review of various options involving transformer deliveries for Sawyer Passway substation. The purpose of this review was to determine if one or both Sawyer Passway Substation transformers could be canceled, thereby eliminating capital expenditures of approximately \$400K per unit. Such a plan would involve the redeployment of one or more existing transformers from Princeton Road substation. Factored into this analysis were system needs at Princeton Road and a number of other substations around the system. The conclusion of this analysis is that FG&E should move forward with delivery of both 12/16/20 MVA transformers ordered for Sawyer Passway. It is recommended that neither transformer order be canceled.

Introduction

FG&E currently owns and operates two 69-13.8 kV, 12/16/20 MVA power transformers at Princeton Road Substation in Fitchburg. These transformers were purchased and installed to serve the Princeton Paper facility, previously operated by NRAC, MRALP, Beloit and other parties. On June 7, 1999, Princeton Paper declared bankruptcy and ceased operations. On May 1, 2000, Princeton Paper voided existing special contracts for energy delivery service, and instead opted for standard G-3 service. The facility was sold at auction to the Newark Group in late June 2000. At this time, electric requirements are minimal and the future is highly uncertain. The Newark Group has tentatively announced plans to operate two machines by the end of 2001, with a total demand requirement of up to 10 MVA.

FG&E is presently constructing a new substation at the Sawyer Passway site in Fitchburg. Two 69-13.8 kV, 12/16/20 MVA power transformers have been specified for this substation as well; both are currently on order. Because of the uncertainties surrounding the future of Princeton Paper, the Sawyer Passway transformers were specified and designed to be thermal and electrical duplicates to the Princeton Road units. This allows the transformers to be interchanged and paralleled with those at Princeton Road.

Given that Princeton Paper will not be operating at the originally specified load levels, engineering has reviewed opportunities to cancel one or both Sawyer Passway transformers, thereby saving an estimated \$400K per unit. One of the two units is already in manufacturing and cannot be canceled. The second unit, however, is scheduled for delivery in 2001 and can be canceled with minimal cancellation fees.

The purpose of this analysis is to examine overall system needs and determine the most appropriate and cost effective strategy to address capacity constraints and system deficiencies.

Factors Considered in Decision

- Each 12/16/20 MVA transformer purchased for Sawyer Passway is valued at \$393K without overheads (invoice cost). Canceling a transformer provides an opportunity to significantly reduce capital expenditures associated with the new substation.
- Offsetting the \$393K savings will be cancellation fees of \$12K, as well as costs associated with draining, disassembling, rigging, trucking, reassembling, vacuum filling and testing an existing transformer if relocated from Princeton Road. These costs are estimated at \$40K. Thus, the net savings will be in the vicinity of \$340K (excluding overheads).
- Only one transformer delivery can be canceled. The transformer scheduled for delivery this year was already in a production slot at the time Princeton Paper voided their contracts for energy delivery service.
- In addition to capacity requirements at Princeton Road and Sawyer Passway, a number of other substations are facing capacity constraints or other deficiencies that must be addressed over the next two years. A myriad of combinations and alternatives were considered to best address the needs of the overall system.
- FG&E owns a 15 MVA mobile substation to provide emergency backup to all radial distribution substations. The rating of the mobile substation imposes a practical limit of 15 MVA on any transformer, regardless of size, unless redundant capacity is designed into the system to provide backup and/or tie capability.
- The lead-time on medium power transformers (> 10 MVA base) is currently estimated at 20 months (1.7 years). Small power transformers (<10 MVA base) have shorter, but still significant delivery lead times. Therefore, planning for new load additions must begin as much as two years in advance of the required in-service date.

Substations Considered in Decision

Beech Street S/S

- The Beech Street transformer is a 69-13.8 kV, 15/20/22.4 MVA LTC unit, MFG 1987.
- A significant amount of load was transferred from this substation to Princeton Road in 1996. Princeton Road is situated much closer to high-density industrial load centers, which could no longer be served from Beech Street without expensive distribution system upgrades. As a result, loading on the Beech Street transformer has averaged only 7.6 - 9.6 MVA (peak) over the last two years.
- The transformer is now lightly loaded and could be better utilized to serve additional load elsewhere.

Princeton Road S/S

- Princeton Road substation currently has three 69-13.8 kV transformers in service. One is a 7.5/10.5 MVA unit, two are 12/16/20 MVA units. All were manufactured in the past five years.
- The 7.5/10.5 MVA transformer is currently loaded to approximately 11.1 MVA (peak). Planned load increases by Fibermark and Boutwell Owens are expected to total as much as 5 MVA in 2001, exceeding the rating of the transformer as well as the mobile substation.
- Princeton Paper, while currently idle, may bring machines on-line by the end of 2001. This load has been estimated at up to 10 MVA.

- Plans are underway to transfer a sizable amount of load from River Street to Princeton Road to better serve industrial customers in the area. This load is expected to add 6-7 MVA to Princeton Road.
- The total substation load is projected to be 16.1 MVA with known customer additions, 22 MVA if load is transferred from River Street, and up to 32 MVA if the Newark Group operates machines as hoped.

Sawyer Passway S/S

- The new Sawyer Passway substation will have two 12/16/20 MVA LTC transformers.
- Load on the new substation is expected to be approximately 15 MVA (peak) when placed in-service, though with some uncertainty due to extensive circuit changes.
- The combined 40 MVA in transformer capacity will also provide back up to Summer Street, which has experienced peak loads of between 12.7 and 16.6 MVA in recent years.

Summer Street S/S

- The Summer Street transformer is a 69-13.8 kV, 21/28/35 MVA non-LTC unit, MFG 1964.
- Load is currently estimated at approximately 12 MVA peak. The substation is resistance grounded, and includes no voltage regulation for the three distribution circuits emanating from this location.
- The resistance grounded distribution system has contributed to significant lightning related reliability concerns in recent years. Protective margins relative to BIL are substantially reduced due to higher arrester MCOV ratings. Effectively grounding the 13.8 kV system at the substation will greatly enhance over-voltage protection..
- The lack of regulation at Summer Street has also caused voltage concerns in recent years. Voltage can be only crudely controlled through capacitor switching. Voltages are marginally high during light load periods (NLTC settings are not available to reduce transformer output voltage). Voltages may also sag to as low as 95% during transmission contingencies, causing concerns with low voltage.
- The age of the transformer should be factored into final decisions. While there is nothing to suggest a problem with the transformer, it is none-the-less a 37-year-old unit with a spotty maintenance history. Substation upgrades to address grounding and regulation concerns should consider a longer-term vision should the transformer fail.

Townsend S/S

- The Townsend transformer is a 69-13.8 kV, 7.5/10.5 MVA LTC unit, MFG 1983.
- The substation is presently loaded to approximately 11.8 MVA on peak.
- Load is expected to increase over the next two years. The maximum summer rating of 12.02 MVA will be exceeded in 2001 or 2002.
- Approximately 4.8 MVA of the Townsend load is associated with a single large customer (Sterilite). This load would be ideally served from a separate 3.75/5.25 MVA transformer, which would offload the existing transformer and provide superior quality of service to this customer.
- Townsend substation was constructed as a two transformer substation with separate low side bays. One transformer was subsequently removed. It would be relatively easy and inexpensive to add a second transformer and feed Sterilite separately.

West Townsend S/S

- The West Townsend transformer is a 69-13.8 kV, 3.75/5.25 MVA LTC unit, MFG 1968.
- The transformer is currently loaded to approximately 4 MVA peak and is not expected to approach ratings limits in the near-term.
- Due to capacity constraints at Townsend, this substation is being considered in the overall substation expansion plan as it may provide an opportunity to address load concerns at Townsend Substation.

Recommended Expansion Plan

- ⇒ Accept delivery of both 12/16/20 MVA transformers for Sawyer Passway. Estimated cost - \$400K.
- ⇒ Leave both 12/16/20 MVA transformers at Princeton Road to serve the estimated 22 MVA of existing area load, while providing capacity for Princeton Paper or other customer additions.
- ⇒ In 2001 or 2002 (as required), move the Princeton Road 7.5/10.5 MVA transformer to West Townsend and replace the existing 3.75/5.25 MVA transformer. Estimated cost - \$100K.
- ⇒ Relocate the 3.75/5.25 MVA West Townsend transformer to Townsend and install in the unused position. Perform work required to remove Sterilite from the existing 7.5/10.5 MVA unit and serve this customer from the relocated transformer. Estimated cost - \$50K.
- ⇒ In 2002, purchase a 10/14 MVA LTC transformer for Beech Street and replace the existing 15/20/22.4 MVA transformer. Estimated cost - \$250K.
- ⇒ Move the existing Beech Street transformer to Summer Street to replace the existing 21/28/35 non-LTC unit. The new transformer will provide an effectively grounded source, regulation (LTC) and a relatively new transformer (13 years old). Estimated cost - \$50K.

Justification

The proposed solution provides the following system benefits:

- Princeton Road Substation will have sufficient capacity to address short term and long term capacity requirements. The capacity at Princeton Road will also allow distribution configuration changes to better serve high-density industrial load centers, improving both reliability and quality of service to sensitive customers.
- Sawyer Passway will have sufficient capacity to address short term and long term capacity requirements. Redundant transformer capacity will allow each 12/16/20 MVA transformer to back up the other (eliminating the mobile substation constraint) and allows for load transfers between Sawyer Passway and Summer Street.
- Capacity constraints in the Townsend and West Townsend area will be addressed indefinitely. A total of 10.5 MVA of new capacity will be allocated between the two substations.
- Summer Street will be converted to an effectively grounded station with an LTC transformer for voltage regulation. Replacing the Beech Street transformer provides a relatively economical solution since a small power transformer can be purchased for roughly 1/2 the cost of a medium power transformer equivalent in size to the Beech Street unit.

- Beech Street Substation will have sufficient capacity to address short term and long term capacity requirements.
- Substation capacity is better distributed within the FG&E system.
- Critical substations at Princeton Road, Sawyer Passway, Summer Street and Beech Street will have relatively new LTC power transformers ranging in age from 0 – 13 years, with modern LTC technology and lower maintenance requirements.
- Reliability and quality of service concerns will be addressed at locations throughout the system, improving service to a large number of customers. In particular, issues involving some of FG&E's largest and most sensitive customers will be addressed, including Munksjo Paper, Crocker Tech, Simonds Saw, K&C Plastics, PGM Plastics, Sterilite and others.

Cost

- For the purposes of this analysis, the "base cost" assumes cancellation of one Sawyer Passway transformer and no other additions or enhancements to the system. Thus, canceling one transformer represents a base of \$0.
- Proceeding with both Sawyer Passway transformer deliveries, and undertaking all other improvements and enhancements identified in the recommendation, including the purchase of a 10/14 MVA transformer for Beech Street, represents a total incremental cost of \$850K (excluding overheads). This cost will be spread over the next two years.
- The recommended plan provides the lowest cost solution to all system constraints and deficiencies, including Princeton Road, Sawyer Passway, Summer Street and Townsend.



Memorandum

To: C. E. Christensen, T. P. Meissner
cc: J. J. Bonazoli, J. D. Hunter, J. A. Kowalski, A. J. Zogopoulos
From: P. A. Krell
Date: May 18, 2000
Re: FG&E Distribution System Load Study – 2000 through 2002

Attached is a brief report on projected FG&E distribution system loads for Summer 2000 through Summer 2002, and an assessment of substation loading limits that may be impacted. This study was performed to guide substation and transmission modification alternatives under consideration in light of the two power transformers presently on order for the new Sawyer Passway S/S and the present absence of large power load at the Mill #8 facility in Fitchburg served by circuits 50W53 and 50W54.

If you have any questions or need more information, please let me know. Thank you.

FG&E DISTRIBUTION SYSTEM LOAD STUDY PROJECTIONS AND ASSESSMENT FOR YEAR 2000 THROUGH YEAR 2002

P. A. Krell
May 18, 2000

This report documents the findings of an abbreviated study to assess peak load potentials for distribution feeders, circuits and substations on the Fitchburg Gas & Electric Light system. The study was purposefully limited to providing short term load growth projections based on the examination of trends in recent peak load data, and consideration for known, likely expansion of certain large power industrial customers. The intent is to produce a two-year projection of peak loads at the substation level for the period of Summer 2000 through Summer 2002 to use as a guide for pending decisions on substation power transformer additions and transmission system modifications.

Summary Findings

The following concerns were identified from the forecasted loads and impact assessment performed under this study. It is important to note that these indications are for the anticipated normal system configuration. Loading for maintenance or contingency loss configurations has not been evaluated as part of this study. Additionally, the combined loadings on the Princeton Road S/S #T2 and #T3 transformers in their existing configuration are not detailed, as they are almost wholly dependent on the magnitude of new load if/when it comes on line at Mill #8.

Princeton Road S/S – Transformer #T1

The coincident combined summer peak demands for the 50W55 and 50W56 circuits is forecast to exceed 15 MVA, surpassing the calculated summer thermal rating of this 7.5/9.375/10.5 MVA unit. This loading level is forecast to occur as a result of (and is contingent upon) the possibility of a 3 to 4 MW expansion at Fibermark on the 50W56 circuit (expected within the next 2 years). If/before this expansion materializes, plans for relief of this unit should be implemented. Without this customer expansion, the combined peak demand of these two circuits is projected to remain between 10 to 12 MVA in both summer and winter peak periods throughout the forecast years, even considering the other assumed customer expansion at Boutwell-Owens of roughly 600 to 700 kVA (expected within 1 year) on the 50W55 circuit.

Townsend S/S – Transformer #T2

The coincident combined summer peak demands for the 15W15 (Sterilite), 15W16 and 15W17 circuits was forecast to exceed 12 MVA, surpassing the calculated summer thermal rating of this 7.5/9.375/10.5 MVA unit. This loading level is forecast to occur in the Summer 2001 peak period, and is not contingent upon the a possible 200 kVA expansion at NEBS on the #15W16 circuit.

In addition to the overloads detailed above, there were two other lesser concerns identified. First is that the load demands for Sterilite are presently approaching 200 amps per phase, and are projected to eventually exceed this. This may be an issue with the set of 200/5 Amp CTs indicated at the 15W15 circuit position at Townsend S/S. Second is that the present CT ratios and phase overcurrent relay

settings for the River Street S/S transformer should be reviewed to confirm that adequate margin exists versus the projected Winter 2001/02 peak demand of 13.7 MVA (approximately 575 amps per phase).

Forecasting Method

A five year history of summer and winter peak demands (Summer 1995 through Summer 1999, Winter 1995/96 through Winter 1999/2000) for each individual radial distribution feeder and circuit, developed through review of monthly load reading data, was used as the basis for forecasting future peak demands. In many cases, certain monthly readings were excluded if they appeared to be inconsistent with the overall history of a given feeder or circuit, or known temporary conditions were in effect. This, combined with instances of missing data, resulted in many cases where less than five years of historical data was available for individual elements.

A linear regression analysis was then performed on the established load histories. The preferred approach for forecasting of future peak demands loads assumed a fixed increment, linear growth rate (as opposed to a compounding percentage growth rate) based on the results of this analysis. Generally, one (1) standard error increment was added to provide a conservative margin to account for factors such as weather variations and other uncertainties inherent in forecasting load growth.

Where the linear regression analysis for a particular circuit or feeder showed a decreasing load trend, the load for that element was either forecast to remain flat, or a revised analysis was performed using only those historical years that were believed to be appropriate for forecasting that element's growth going forward. As above, one (1) standard error from the regression analysis was added wherever deemed appropriate. It should be noted that there were many additional variations in the forecasting details for individual elements, based on the available load data and known historical conditions.

The forecasting methodology used for this study, albeit using a linear rather than geometrically compounding growth rate, was intended to err on the conservative side (higher load), so as to indicate early timeframes that system additions or improvements might be needed.

In addition to the linear growth evaluation, individual circuit and feeder load forecasts were modified with certain system changes and customer expansions known or assumed to be occurring within the study period. The following specific modifications were taken into account at the time of the indicated peaks:

Winter 1999/00

- Electric Station circuit 02H02 (major portion) transferred to Pleasant Street circuit 31W37

Summer 2000

- Rindge Road circuit 35H36 (major portion) transferred to new 21W36 circuit
- Electric Station circuit 02H04 transferred to Pleasant Street circuit 31H34
- Boutwell-Owens (Princeton Road circuit 50W55) – expansion doubling 659 kVA demand

Winter 2000/01

- Electric Station circuit 02H01 (approx. half) transferred to Canton Street circuit 11H10
- Electric Station circuit 02H01 (approx. half) transferred to Beech Street circuit 01W04
- Fibermark (Princeton Road circuit 50W56) – 4 MVA expansion
- NEBS (Townsend circuit 15W16) – 200 kVA expansion
- new Fitchburg High School (new circuit 21W36) – 1500 kVA addition

Summer 2001

- Electric Station circuits 02H09 and 02H13, remaining load on circuit 02H02, and non-Network distribution load from Electric Station feeder 02F08 transferred to new Sawyer Passway 13.8 kV circuit (numbering yet to be designated)

Once forecasting was completed for individual circuits and feeders, the resulting substation transformer loads were estimated using the sum of the individual circuit loads that it was supplying, multiplied by the maximum coincidence factor demonstrated by the historical data (or simply the sum of the circuit loads if the historical record resulted in coincidence factors greater than 1.)

See the attached tables on pages 4 and 5 for the historical and projected loads resulting from this study.

Impact Assessment

The forecasted loads determined from the methods described above were compared to known limitations of substation equipment, including the power transformers, phase overcurrent protection settings, metering and protection CT primary selections, in-line switches, non-LTC voltage regulation equipment, and conductors.

Only anticipated normal system configurations were studied. No contingency or maintenance configuration capabilities were reviewed. Likewise, conditions beyond the substation, out on the circuits and feeders, were not studied for either voltage or loading concerns.

FGandE Distribution System Load Study

Distribution Element	Summer Peak Loads (three-phase kVA)							
	Historical					Projected		
	1995	1996	1997	1998	1999	2000	2001	2002
Beech St. #1 Xfmr	15,936	15,552	12,238	9,561	7,649	forecast not completed		
01W01	6,144	6,208	4,207	3,378	3,060			
01W02	1,472	1,600	446	1,339	2,295	1,339	1,339	1,339
01W04	1,920	1,536	2,040	2,422	2,358	2,774	3,460	3,626
01W06	6,784	7,680	5,609	2,040	255	245	245	245
Canton St. 13.8 kV #1 Xfmr	5,376	5,088	5,306	5,163	5,450	5,559	5,559	5,559
11W11	5,320	5,040	4,940	4,980	5,338	5,559	5,559	5,559
Canton St. 4.16 kV #2 Xfmr	1,248	1,200	1,225	1,225	1,249	1,361	1,663	1,674
11H10	504	504	588	576	492	600	1,131	1,142
11H11	828	846	847	829	829	840	840	840
Electric Station 13.8 kV	only the sum of the radial load is shown here -->					15,130	0	0
02F08	2,640	2,520	2,964	3,179	3,179	3,570	0	0
02F10	3,000	3,840	3,299	3,514	3,801	4,207	0	0
02F10/113	1,440	1,200	1,458	1,147	1,171	1,310	0	0
02F11	3,120	3,240	3,036	2,892	1,625	1,625	0	0
02F17	240	2,400	3,442	287	2,534	700	0	0
Electric Station 4.16 kV #6 Xfmr	5,616	4,656	4,804	4,765	5,022	3,717	0	0
02H01	1,260	972	865	937	992	1,040	0	0
02H02	864	612	576	608	704	72	0	0
02H04	2,088	1,800	1,511	1,528	1,686	0	0	0
02H09	1,296	936	925	987	1,175	1,271	0	0
02H13	1,296	1,368	1,038	1,095	1,333	1,335	0	0
Lunenburg 13.8 kV Xfmr		5,280	6,119	6,024	5,641	6,572	6,746	6,919
30W30	4,416	4,352	4,717	5,227	4,844	5,489	5,662	5,835
30W31			1,084	1,084	637	1,084	1,084	1,084
Nokege 4.16 kV Xfmr	2,419	2,534	2,738	2,796	2,911	3,180	3,260	3,339
20H22	1,109	1,210	1,110	1,138	1,311	1,355	1,388	1,421
20H23	1,094	864	865	879	836	916	916	916
20H24	1,109	1,267	1,268	1,297	1,398	1,495	1,566	1,617
Pleasant St. 4.16 kV Xfmr	408	480	793	817	721	2,599	2,726	2,854
31H34	984	972	1,045	1,105	1,117	2,599	2,726	2,854
Pleasant St. 13.8 kV Xfmr	9,984	9,696	9,179	9,370	9,561	10,982	10,998	11,013
31W37	5,120	5,568	4,781	5,291	5,354	6,443	6,483	6,482
31W38	7,424	7,168	7,394	7,458	7,203	7,355	7,355	7,355
Princeton Rd #1 Xfmr		11,381	10,685	11,147		11,104	15,104	15,116
50W55		7,803	7,203	7,944	5,928	7,405	7,405	7,405
50W56		3,610	3,649	3,530	3,689	3,730	7,742	7,753
Princeton Rd #2 Xfmr		18,267	3,060	6,286		forecasts not performed for		
Princeton Rd #3 Xfmr						Princeton Rd. S/S		
50W51		4,806	717	606	8,748	Xfmr #2 and Xfmr #3		
50W53		10,903	3,091	5,426	6,940	loads		
50W54		12,035	653	1,378	1,697			
Rindge Rd 4.16 kV Xfmr	1,392	1,224	1,273	1,369	1,513	712	712	712
35H35	614	480	538	557	557	612	612	612
35H36	806	778	874	865	961	100	100	100
21W36						913	2,453	2,493
River St. 13.8 kV Xfmr	10,200	11,775	11,952	11,872	12,430	12,353	12,645	12,937
Munksjo	4,800	4,960	5,418	5,498		5,423	5,779	6,134
25W27	2,668	3,776	2,167	2,358		2,550	2,550	2,550
25W28	4,992	7,580	6,948	6,820	6,135	7,048	7,048	7,048
Sawyer Passway 13.8 kV	only the sum of the radial load is shown here -->					14,397	14,776	
new Circuit #X						4,045	4,123	
new Feeder #8						2,382	2,556	
new Feeder #10						4,334	4,462	
new Feeder #10A								
new Feeder #10B								
new Feeder #11						1,625	1,625	
new Feeder #17						700	700	
S. Fitchburg 4.16 kV Xfmr	1,411	1,411	1,268		1,355	1,808	1,848	1,889
5H06	970	1,104	884		980	1,088	1,088	1,088
5H12	432	566	519		624	720	760	800
Summer St. 13.8 kV B123 Xfmr	14,400	14,080	15,935	16,573	12,748	11,229	11,829	12,430
40F3A	6,824	6,824	6,406	6,502	4,303	0	0	0
40F9	5,280	5,280		0	5,163	0	0	0
40F38						2,677	2,688	2,699
40F39	2,960	3,720	3,984	4,542	4,701	5,447	5,877	6,307
40F40	3,040	3,040	2,550	2,550	2,868	3,105	3,264	3,423
Townsend 13.8 kV Xfmr	10,176	10,176	9,752	10,900	10,995	11,818	12,234	12,490
Sterile	4,428	4,738	4,429	4,678	4,602	4,816	4,845	4,874
15W16	3,680	3,552	4,398	4,079	4,119	4,692	5,033	5,174
15W17	3,072	2,592	2,645	2,677	2,805	2,879	2,946	3,013
15W17A	4,565	2,688	0	0	0	0	0	0
Wallace Rd 13.8 kV						forecast not completed		
21F41								
W. Fitchburg 4.16 kV Xfmr	672	672	817	865	733	1,177	1,222	1,266
27H26	960	893	951	1,028	1,114	1,177	1,222	1,266
W. Townsend 13.8 kV Xfmr	3,328	3,264	3,378	3,601	3,633	3,890	3,970	4,050
39W18	1,760	1,792	1,848	1,944	1,912	2,022	2,067	2,113
39W19	1,760	1,728	1,928	1,896	1,864	2,022	2,060	2,097

FGandE Distribution System Load Study

Distribution Element	Winter Peak Loads (three-phase kVA)						Projected
	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
Beech St. #1 Xfmr	15,360	8,256	13,003	13,386	8,509	forecast not completed	
01W01	7,104	5,952	3,123	3,888	3,442		
01W02	1,536		1,275	1,339	2,358	1,402	1,402
01W04	2,112		1,657	1,976		2,814	2,819
01W06	7,296		6,183	5,163	1,785	245	245
Canton St. 13.8 kV #1 Xfmr	5,328	4,800	4,637	4,781	5,259	5,450	5,484
11W11	5,280	4,840	5,020	4,980	5,378	5,450	5,484
Canton St. 4.16 kV #2 Xfmr	1,248	1,152	1,201	1,057	1,273	1,866	1,885
11H10	516	576	588	576	588	1,155	1,175
11H11	828	828	865	829	829	855	855
Electric Station 13.8 kV	only the sum of the radial load is shown here -->						11,907
02F08	2,880	2,544	2,534	2,534	2,510	2,512	0
02F10	3,240	3,240	3,227	3,490	3,490	3,647	0
02F10/113	960	792	789	837	789	839	0
02F11	3,120	2,880	2,773	2,271	1,386	1,386	0
02F17	3,000	2,160	2,199	717	191	700	0
Electric Station 4.16 kV #6 Xfmr	5,688	6,204	6,050	5,238	4,727	2,822	0
02H01	1,296	972	829	934	975	0	0
02H02	792	576	572	627	72	72	0
02H04	2,088	1,428	1,326	1,705	1,307	0	0
02H09	756	1,070	893	975	1,066	1,228	0
02H13	1,728	1,356	1,191	1,345	1,422	1,522	0
Lunenburg 13.8 kV Xfmr		5,760	5,928	6,024	5,968	6,590	6,801
30W30		4,416	5,036	5,163	5,099	5,719	5,937
30W31			1,084	1,084	1,115	1,084	1,084
Nocke 4.16 kV Xfmr	2,534	2,477	2,508	2,853	2,908	3,193	3,267
20H22	1,238	1,152	1,153	1,225	1,317	1,354	1,377
20H23	806	806	836	807	847	862	871
20H24	1,267	1,123	1,283	1,326	1,444	1,542	1,598
Pleasant St. 4.16 kV Xfmr	480	528	721	1,009	745	2,775	2,949
31H34	888	852	1,067	937	1,021	2,775	2,949
Pleasant St. 13.8 kV Xfmr	9,984	9,696	8,988	9,083	9,724	10,981	10,981
31W37	5,312	5,248	4,972	5,227	5,807	6,069	6,069
31W38	6,656	7,872	6,310	6,502	6,438	7,095	7,095
Princeton Rd #1 Xfmr		10,975	10,709	8,533		14,497	14,497
50W55		7,157	6,996	5,530	5,585	6,697	6,697
50W56		3,834	3,737	3,338	3,617	7,821	7,821
Princeton Rd #2 Xfmr		3,164	2,948	4,916		forecasts not performed for Princeton Rd. S/S Xfmr #2 and Xfmr #3 loads	
Princeton Rd #3 Xfmr							
50W51		638	446		1,944		
50W53		3,037	2,789	6,494	2,637		
50W54		717	629	1,856	1,657		
Rindge Rd 4.16 kV Xfmr	1,248	1,224	1,201	1,681	1,441	1,003	1,070
35H35	480	499	538	817	653	903	970
35H36	922	922	970	1,028	951	100	100
21W36						2,449	2,466
River St. 13.8 kV Xfmr	10,950	10,850	11,952	12,270	12,748	13,234	13,735
Munksjo	4,960	5,040	5,259	6,533	5,386	6,238	6,818
25W27	2,816	5,824	2,231	2,103		2,358	2,358
25W28	6,784	6,784	6,374	5,737	6,565	6,756	6,756
Sawyer Passway 13.8 kV	only the sum of the radial load is shown here -->						11,904
new Circuit #X							4,215
new Feeder #8							1,041
new Feeder #10							3,722
new Feeder #10A							839
new Feeder #10B							1,386
new Feeder #11							700
new Feeder #17							
S. Fitchburg 4.16 kV Xfmr	1,411	1,210	1,441	1,211	1,268	1,738	1,814
5H06	778	787	826	836	981	1,023	1,068
5H12	538	499	432	615	635	715	746
Summer St. 13.8 kV B123 Xfmr	13,760	13,760	14,979	15,617	10,836	11,292	11,849
40F3A	6,624	6,432	6,406	6,310	6,215	0	0
40F9	5,280	5,184	0	5,163	5,259	0	0
40F38						2,630	2,657
40F39	2,480	3,960	4,143	4,701	4,860	5,353	5,679
40F40	3,040	2,400	1,912	2,550	2,868	3,308	3,513
Townsend 13.8 kV Xfmr	9,504	9,504	9,370	9,752	9,944	10,907	11,065
Sterlite	4,667	4,695	4,837	4,856	4,725	4,736	4,743
15W16	3,488		3,506	3,609	3,960	4,284	4,389
15W17	2,784	2,656	2,741	3,506	2,709	3,477	3,547
15W17A	4,102	2,080	0	0	0	0	0
Wallace Rd 13.8 kV						forecast not completed	
21F41							
W. Fitchburg 4.16 kV Xfmr	696	756	757	817	737	1,225	1,251
27H26	1,094	1,046	1,095	1,114	1,191	1,225	1,251
W. Townsend 13.8 kV Xfmr	4,288	3,712	3,729	3,920	3,856	4,077	4,110
39W18	1,824	1,984	1,817	1,912	1,912	2,000	2,010
39W19	2,192	2,112	2,135	2,263	2,239	2,322	2,346

Concord									
Conference Center	N	Commercial St	Conference Center (Horseshoe Pond)	500	\$18,600	In Construction	Q3 2000	In Construction	
Bow Cold Storage	N	Ryan Rd, Bow	Refrigerated Storage 50,000 sq ft	200	\$7,440	Construction Starts Summer 2000	Q4 2000	In Construction	
Advanced Recycling	E		New Shredding Equipment	2,000	\$74,400	Sept - Oct 2000	Q3 2000	In Construction	
Office Building #3	N	Commercial St	Office Building (Horseshoe Pond)	300	\$11,160	Start Fall/Winter 2000/01	Q2 2001	Construction to begin Sep or Oct 2000	
Summit Packaging Phase I	N	Whitney Rd	Plastics Manufacturing	1,400	\$52,080	Start Spring 2001	Q3 2001	Good Prospect	
Office Building 15-18K sq ft	N	Commercial St	Horseshoe Pond Lot 5	300	\$11,160	Preliminary	Q4 2001	Prospect	
Prospect D	N		Retail Complex	1,000	\$37,200	Preliminary	Q2 2002	Prospect	
Summit Packaging Phase II	E	Whitney Rd	Plastics Manufacturing	800	\$29,760		Q2 2002	Good Prospect	
Summit Packaging Phase III	E	Whitney Rd	Plastics Manufacturing	800	\$29,760		Q3 2002	Good Prospect	
Summit Packaging Phase IV	E	Whitney Rd	Plastics Manufacturing	400	\$14,880		Q2 2003	Good Prospect	
Exeter									
QA Technologies	N	Towle Farm Rd, Hampton	Electronics Manufacturing	750	\$27,900	In Construction	Q3 2001	In Construction	
Kaif Technologies	N	Continental Dr, Exeter	Plastics Manufacturing	1,000	\$37,200	Preliminary	Q4 2001	Good Prospect	
Prospect A	N	Continental Dr, Exeter	Refrigerated Warehouse - 100,000 sq ft	1,000	\$37,200	Preliminary	Q2 2001	Prospect	
Prospect B	N	Ledge Rd, Seabrook	Automated Warehouse - 500,000 sq ft	1,000	\$37,200	Preliminary	Q2 2001	Prospect	
Prospect C	N	Star Rd, Seabrook	Injection Molding Tools Manufacturing	500	\$18,600	Preliminary	Q2 2001	Prospect	
Fitchburg									
Premier Corrugated Box	E	River St	Manufacturing	1,600	\$115,264	Complete 10/00	Q4 2000	Good Prospect	
Minuteman International	E	Stevens Rd	Distribution/Manufacturing	300	\$21,614	Complete 12/00	Q4 2000	Good Prospect	
Painum Place Bus & Ind Ctr	E	Boulder Dr	Mix. Light MFG & Office	1,500	\$108,060	Occupied Fall/Winter 2000/01	Q1 2001	In Construction	
Boutwell-Owen	E	Industrial Rd, 231 Park	Manufacturing	1,500	\$108,060	Start Fall/Winter 2000/01	Q1 2001	Good Prospect	
FiberMark	E	Princeton Rd	Paper Manufacturing	3,500	\$252,135	Preliminary	Q2 2001	Prospect	

FG&E Substation Transformer Plan **Alternatives Discussion**

Option 1: Cancel both Tx's for Sawyer Passway. Use 2 Tx's from Princeton Rd. Buy a new 10 MVA Tx for Princeton Rd.

This option is not feasible now as one Tx has already been purchased.

Option 2: Cancel one Tx for Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Summer St. Convert #9 Feeder to 69 kV. Buy a new 10 MVA Tx for Princeton Rd. Buy a new 10 MVA Tx for West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite.

This option is only feasible if the proposed load transfer from River St. to Princeton Rd. is cancelled or reversed. If not, the remaining Tx's at Princeton Rd. will not have the capacity to serve peak loads in 2002.

PRO's: All current capacity issues are resolved with the exception of Princeton Paper. Summer St. transformer and voltage issues are resolved with a new LTC Tx.

CON's: Princeton Paper load limited on the remaining Tx's @ Princeton Rd.
Little room for growth on Princeton Rd. Tx's.

Option 3: Cancel one Tx for Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Sawyer Passway. Add voltage regulation @ Summer St. Move T1 Tx (10MVA) from Princeton Rd. to West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite.

This option is only feasible if the proposed load transfer from River St. to Princeton Rd. is cancelled or reversed. If not, the remaining Tx at Princeton Rd. will not have the capacity to serve peak loads in 2002. Assuming the load transfer is reversed, here are the pro's and con's:

PRO's: All current capacity issues are resolved with the exception of Princeton Paper. Summer St. voltage issues are resolved with new regulation.

CON's: Princeton Paper load limited on the remaining Tx's @ Princeton Rd.
Summer St. Tx is an old unit and is not replaced in this option.
Little room for growth on Princeton Rd. Tx's.

Option 4: Don't cancel any Tx's for Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Summer St. Convert #9 Feeder to 69 kV. Move T1 Tx (10MVA) from Princeton Rd. to West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite.

This option is only feasible if the proposed load transfer from River St. to Princeton Rd. is cancelled or reversed. If not, the remaining Tx at Princeton Rd. will not have the capacity to serve peak loads in 2002.

PRO's: All current capacity issues are resolved with the exception of Princeton Paper. Summer St. voltage issues are resolved with new LTC Tx.

CON's: Princeton Paper cannot be served from the remaining Tx @ Princeton Rd.
Summer St. Tx is an old unit and is not replaced in this option.
Little room for growth on Princeton Rd. Tx's.

FG&E Substation Transformer Plan

Alternatives Discussion

Option 5: Don't cancel any Tx's for Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Summer St. Convert #9 Feeder to 69 kV. Buy a new 10 MVA Tx for West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite.

The FG&E mobile is rated at 15 MVA. At Princeton Rd., load on the remaining Tx (20MVA) will be over the mobile's capability in the event of a Tx contingency. As a result, some load will have to be transferred to another substation. Plans to make this transfer are required if this solution is implemented.

PRO's: All current capacity issues are resolved with the exception of Princeton Paper. Summer St. transformer and voltage issues are resolved with new LTC Tx.

CON's: Princeton Paper load limited on the remaining Tx's @ Princeton Rd.
Mismatched transformers at Princeton Rd.
Little room for growth on Princeton Rd. Tx's.

Option 6: Cancel one Tx for Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Sawyer Passway. Buy a new 10 MVA Tx for West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite.

The FG&E mobile is rated at 15 MVA. At Princeton Rd., load on the remaining Tx (20MVA) will be over the mobile's capability in the event of a Tx contingency. As a result, some load will have to be transferred to another substation. Plans to make this transfer are required if this solution is implemented.

PRO's: All current capacity issues are resolved with the exception of Princeton Paper.

CON's: Princeton Paper load limited on the remaining Tx's @ Princeton Rd.
Summer St. transformer & voltage issues are not resolved.
Mismatched transformers at Princeton Rd.
Little room for growth on Princeton Rd. Tx's.

Option 7: Don't cancel any Tx's for Sawyer Passway. Add voltage regulation @ Summer St. Move T1 Tx (10MVA) from Princeton Rd. to West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite.

PRO's: All current capacity issues are resolved.
Summer St. voltage issues are resolved with new regulation.
Allows for up to 10 MVA of load @ Princeton Paper.
Some room for growth @ Princeton Rd.

CON's: Summer St. Tx is an old unit and is not replaced in this option.

Option 8: Don't cancel any Tx's for Sawyer Passway. Move T1 Tx (10MVA) from Princeton Rd. to West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite.

PRO's: All current capacity issues are resolved.
Allows for up to 10 MVA of load @ Princeton Paper.
Some room for growth @ Princeton Rd.

CON's: Summer St. transformer & voltage issues are not resolved.

FG&E Substation Transformer Plan **Alternatives Discussion**

Option 9: Cancel one Tx for Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Summer St. Convert #9 Feeder to 69 kV. Move T1 Tx (10MVA) from Princeton Rd. to West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite. Buy 2 new 14 MVA Tx's for Princeton Rd.

PRO's: All current capacity issues are resolved.
Allows for up to 7 MVA of load @ Princeton Paper.
Summer St. transformer and voltage issues are resolved with new LTC Tx.

CON's: Little room for growth on Princeton Rd. Tx's (after adding Princeton Paper).

Option 10: Cancel one Tx for Sawyer Passway. Use 1 Tx (20MVA) from Princeton Rd. @ Sawyer Passway. Move T1 Tx (10MVA) from Princeton Rd. to West Townsend. Move Tx (5MVA) from West Townsend to Townsend for Sterilite. Buy 1 new 14 MVA Tx's for Princeton Rd.

PRO's: All current capacity issues are resolved.
Allows for up to 7 MVA of load @ Princeton Paper.
Some room for growth @ Princeton Rd.

CON's: Mismatched transformers at Princeton Rd.

FG&E Substation Transformer Plan **Alternatives Discussion**

Option 1: \$ 1,465,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	7.5/10.5 LTC	21/28/35	7.5/40.5 LTC	7.5/10.5 LTC
12/16/20 LTC	7.5/10.5 LTC			3.75/5.25 LTC

Option 2: \$ 1,262,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	7.5/10.5 LTC	12/16/20 LTC	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC	7.5/10.5 LTC	Convert #9 to 69kV		3.75/5.25 LTC

Option 3: \$ 502,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	12/16/20 LTC	Add Regulation	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC				3.75/5.25 LTC

Option 4: \$ 1,073,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	12/16/20 LTC	12/16/20 LTC	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC		Convert #9 to 69kV		3.75/5.25 LTC

Option 5: \$ 1,298,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	12/16/20 LTC	12/16/20 LTC	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC	7.5/10.5 LTC	Convert #9 to 69kV		3.75/5.25 LTC

Option 6: \$ 427,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	12/16/20 LTC	21/28/35	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC	7.5/10.5 LTC			3.75/5.25 LTC

Option 7: \$ 855,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	12/16/20 LTC	Add Regulation	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC	12/16/20 LTC			3.75/5.25 LTC

Option 8: \$ 555,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	12/16/20 LTC	21/28/35	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC	12/16/20 LTC			3.75/5.25 LTC

Option 9: \$ 1,362,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	10/14 LTC	12/16/20 LTC	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC	10/14 LTC	Convert #9 to 69kV		3.75/5.25 LTC

Option 10: \$ 537,000

Sawyer Passway	Princeton Rd.	Summer St.	West Townsend	Townsend
12/16/20 LTC	12/16/20 LTC	21/28/35	7.5/10.5 LTC	7.5/10.5 LTC
12/16/20 LTC	10/14 LTC			3.75/5.25 LTC

Black: Existing

Red: Moved

Bold Red: Purchased

FGE Substation Transformers Plan Alternatives

Option 1: Cancel Both Sawyer Passway Transf's - Use T2(12/16/20 MVA) and T3(12/16/20 MVA) from Princeton Rd. at Sawyer Passway	\$1,465,000
Option 2: Cancel one Transf for Sawyer Passway Move T2(12/16/20 MVA) from Princeton Rd to Sawyer Passway Move T3(12/16/20 MVA) from Princeton Rd to Summer St Buy new 7.5/10.5 MVA Transf for Princeton Rd. Keep T1(7.5/10.5 MVA) at Princeton Rd. Convert #9 feeder to 69 kV Buy new 7.5/10.5 MVA Transf for West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite	\$1,262,000
Option 3: Cancel one Transf for Sawyer Passway Move T2(12/16/20 MVA) from Princeton Rd to Sawyer Passway Keep T3(12/16/20 MVA) at Princeton Rd Move T1(7.5/10.5 MVA) from Princeton Rd to West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite Add Voltage Regulation @ Summer St.	\$502,000
Option 4: Do not cancel Tansf for Sawyer Passway Keep T2(12/16/20 MVA) at Princeton Rd Move T3(12/16/20 MVA) from Princeton Rd to Summer St Convert #9 feeder to 69 kV Move T1(7.5/10.5 MVA) from Princeton Rd to West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite	\$1,073,000
Option 5: Do not cancel Tansf for Sawyer Passway Move T3(12/16/20 MVA) from Princeton Rd to Summer St Convert #9 feeder to 69 kV Buy new 7.5/10.5 MVA Transf for West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite	\$1,298,000
Option 6: Cancel one Transf for Sawyer Passway Move T3(12/16/20 MVA) from Princeton Rd to Sawyer Passway Buy new 7.5/10.5 MVA Transf for West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite	\$427,000
Option 7: Do not cancel Tansf for Sawyer Passway Add Voltage Regulation @ Summer St. Move T1(7.5/10.5 MVA) from Princeton Rd to West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite	\$855,000
Option 8: Do not cancel Tansf for Sawyer Passway Move T1(7.5/10.5 MVA) from Princeton Rd to West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite	\$555,000

FGE Substation Transformers Plan Alternatives

Option 9: Cancel one Transf for Sawyer Passway Buy 2 new 10/14 MVA Transf's for Princeton Rd Move T1(7.5/10.5 MVA) from Princeton Rd to West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite Move T2(12/16/20 MVA) from Princeton Rd to Sawyer Passway Move T3(12/16/20 MVA) from Princeton Rd to Summer St. Convert #9 feeder to 69 kV	\$1,362,000
Option 10: Cancel one Transf for Sawyer Passway Buy 1 new 10/14 MVA Transf's for Princeton Rd Move T1(7.5/10.5 MVA) from Princeton Rd to West Townsend Move West Townsend 3.75/5.25 unit to Townsend for Sterilite Move T2(12/16/20 MVA) from Princeton Rd to Sawyer Passway	\$537,000

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #1 Cancel both Sawyer Passway transformers
Use both Princeton Rd units at Sawyer Passway
Purchase new 7.5/10.5 for Princeton Road
Add Voltage regulation at Summer St
Purchase new 7.5/10.5 for West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite

Sawyer Passway S/S		
	Cancellation fee	393,000
	Circuit switcher adder	12,000
Princeton Rd S/S		
	Move both PR 12/16/20 units to SP	80,000
	Purchase new 7.5/10.5 transf	250,000
	Installation & testing	15,000
	Move existing to T2 position	15,000
	P&C	30,000
	Distribution line reconfiguration	50,000
Summer St S/S		
	Purchase voltage regulation	250,000
	Installation	50,000
West Townsend S/S		
	Purchase new 7.5/10.5 transf	250,000
	Installation & testing	20,000
	Move existing to Townsend (Sterilite)	20,000
Townsend S/S		
	Install 3.75/5.25 for Sterilite	30,000
Total		1,465,000
Total installed MVA		

Sawyer Passway S/S	40.00
Summer St S/S	35.00
Princeton Rd S/S	21.00
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	0.00
Total	122.25

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #2 Cancel one Sawyer Passway transformer
Use one Princeton Rd unit at Sawyer Passway
Use one Princeton Rd unit at Summer
Purchase new 7.5/10.5 for Princeton Road
Purchase new 7.5/10.5 for West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite
Convert #9 Feeder to 69 kV (07 Line)

Sawyer Passway S/S	
Circuit switcher adder	12,000
Purchase & install bus tie breaker	75,000
Princeton Rd S/S	
Move one PR 12/16/20 unit to SP	40,000
Move one PR 12/16/20 unit to Summer	40,000
Purchase new 7.5/10.5 transf	250,000
Installation & testing	15,000
Move existing to T2 position	15,000
P&C	30,000
Distribution line reconfiguration	50,000
Summer St S/S	
Remove existing unit	10,000
Install PR unit	50,000
07 Line reconfiguration	30,000
Relaying	25,000
06 & 07 Line Breakers	200,000
Build new 9 Feeder	100,000
West Townsend S/S	
Purchase new 7.5/10.5 transf	250,000
Installation & testing	20,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000

Total 1,262,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	20.00
Princeton Rd S/S	21.00
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	35.00

Total 142.25

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #3 Cancel one Sawyer Passway transformer
Keep & use one 12/16/20 at Princeton Road
Use one Princeton Rd unit at Sawyer Passway
Add Voltage regulation at Summer St
Use 7.5/10.5 Princeton Rd unit at West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite

Sawyer Passway S/S	
Circuit switcher adder	12,000
Princeton Rd S/S	
Move one PR 12/16/20 unit to SP	40,000
Move PR 7.5/10.5 unit to West Townsend	20,000
P&C	10,000
Distribution line reconfiguration	50,000
Summer St S/S	
Purchase voltage regulation	250,000
Installation	50,000
West Townsend S/S	
Install 7.5/10.5 transf	20,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000
	Total
	502,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	35.00
Princeton Rd S/S	20.00
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	0.00
Total	121.25

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #4 Don't cancel Sawyer Passway transformer
Keep & use one 12/16/20 at Princeton Road
Use one Princeton Rd unit at Summer
Move Princeton Rd 7.5/10.5 to West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite
Convert #9 Feeder to 69 kV (07 Line)

Sawyer Passway S/S	
Second transformer	393,000
Purchase & install bus tie breaker	75,000
Princeton Rd S/S	
Move one PR 12/16/20 unit to Summer	40,000
Move PR 7.5/10.5 unit to West Townsend	20,000
P&C	10,000
Distribution line reconfiguration	50,000
Summer St S/S	
Remove existing unit	10,000
Install PR unit	50,000
07 Line reconfiguration	30,000
Relaying	25,000
06 & 07 Line Breakers	200,000
Build new 9 Feeder	100,000
West Townsend S/S	
Install 7.5/10.5 transf	20,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000

Total 1,073,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	20.00
Princeton Rd S/S	20.00
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	35.00
Total	141.25

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #5 Don't cancel Sawyer Passway transformer
Keep & use one 12/16/20 & 7.5/10.5 at Princeton Road
Use one Princeton Rd unit at Summer
Purchase new 7.5/10.5 for West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite
Convert #9 Feeder to 69 kV (07 Line)

Sawyer Passway S/S	
Second transformer	393,000
Purchase & install bus tie breaker	75,000
Princeton Rd S/S	
Move one PR 12/16/20 unit to Summer	40,000
P&C	10,000
Distribution line reconfiguration	50,000
Summer St S/S	
Remove existing unit	10,000
Install PR unit	50,000
07 Line reconfiguration	30,000
Relaying	25,000
06 & 07 Line Breakers	200,000
Build new 9 Feeder	100,000
West Townsend S/S	
Purchase new 7.5/10.5	250,000
Installation & testing	15,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000
	Total
	1,298,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	20.00
Princeton Rd S/S	30.50
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	35.00
Total	151.75

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #6 Cancel one Sawyer Passway transformer
Keep & use one 12/16/20 & 7.5/10.5 at Princeton Road
Use one Princeton Rd unit at Sawyer Passway
Purchase new 7.5/10.5 for West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite

Sawyer Passway S/S	
Circuit switcher adder	12,000
Princeton Rd S/S	
Move one PR 12/16/20 unit to SP	40,000
P&C	10,000
Distribution line reconfiguration	50,000
West Townsend S/S	
Purchase new 7.5/10.5	250,000
Installation & testing	15,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000
	Total
	427,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	35.00
Princeton Rd S/S	30.50
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	0.00
Total	131.75

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #7 Don't cancel Sawyer Passway transformer
Keep & use both 12/16/20s at Princeton Road
Use 7.5/10.5 Princeton Rd unit at West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite
Add voltage regulation at Summer St

Sawyer Passway S/S	
Second transformer	393,000
Circuit switcher adder	12,000
Princeton Rd S/S	
Move 7.5/10.5 to W Townsend	20,000
P&C	10,000
Distribution line reconfiguration	50,000
Summer St S/S	
Purchase voltage regulation	250,000
Installation	50,000
West Townsend S/S	
Install 7.5/10.5 transf	20,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000
	Total
	855,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	35.00
Princeton Rd S/S	40.00
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	0.00
Total	141.25

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #8 Don't cancel Sawyer Passway transformer
Keep & use both 12/16/20s at Princeton Road
Use 7.5/10.5 Princeton Rd unit at West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite

Sawyer Passway S/S		
Second transformer		393,000
Circuit switcher adder		12,000
Princeton Rd S/S		
Move 7.5/10.5 to W Townsend		20,000
P&C		10,000
Distribution line reconfiguration		50,000
West Townsend S/S		
Install 7.5/10.5 transf		20,000
Move existing to Townsend (Sterilite)		20,000
Townsend S/S		
Install 3.75/5.25 for Sterilite		30,000
	Total	555,000
Total installed MVA		
Sawyer Passway S/S	40.00	
Summer St S/S	35.00	
Princeton Rd S/S	40.00	
Townsend S/S	15.75	
West Townsend S/S	10.50	
Spare	0.00	
	Total	141.25

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #9 Cancel one Sawyer Passway transformer
Use one Princeton Rd unit at Sawyer Passway
Use one Princeton Rd unit at Summer
Purchase two 10/14s for Princeton Road
Use Princeton Rd 7.5/10.5 for West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite
Convert #9 Feeder to 69 kV (07 Line)

Sawyer Passway S/S	
Circuit switcher adder	12,000
Purchase & install bus tie breaker	75,000
Princeton Rd S/S	
Move one PR 12/16/20 unit to SP	40,000
Move one PR 12/16/20 unit to Summer	40,000
Purchase two new 10/14 transf	600,000
Installation & testing	30,000
P&C	30,000
Distribution line reconfiguration	50,000
Summer St S/S	
Remove existing unit	10,000
Install PR unit	50,000
07 Line reconfiguration	30,000
Relaying	25,000
06 & 07 Line Breakers	200,000
Build new 9 Feeder	100,000
West Townsend S/S	
Install 7.5/10.5 transf	20,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000

Total 1,362,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	20.00
Princeton Rd S/S	28.00
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	35.00

Total 149.25

Princeton Road Transformer Options:

PRoption.wk3
08/11/2000

All options include the following system status and improvements:

Sawyer Passway S/S - Two 12/16/20 MVA units are installed
Princeton Rd S/S - Add distribution transformer capacity
Townsend S/S - Add distribution transformer capacity
West Townsend S/S - Add distribution transformer capacity

Option #10 Cancel one Sawyer Passway transformer
Use one Princeton Rd unit at Sawyer Passway
Purchase one 10/14 for Princeton Road
Use Princeton Rd 7.5/10.5 for West Townsend
Move West Townsend 3.75/5.25 unit to Townsend for Sterilite

Sawyer Passway S/S	
Circuit switcher adder	12,000
Princeton Rd S/S	
Move one PR 12/16/20 unit to SP	40,000
Move PR 7.5/10.5 unit to WT	20,000
Purchase one new 10/14 transf	300,000
Installation & testing	15,000
P&C	30,000
Distribution line reconfiguration	50,000
West Townsend S/S	
Install 7.5/10.5 transf	20,000
Move existing to Townsend (Sterilite)	20,000
Townsend S/S	
Install 3.75/5.25 for Sterilite	30,000
	Total
	537,000

Total installed MVA

Sawyer Passway S/S	40.00
Summer St S/S	35.00
Princeton Rd S/S	34.00
Townsend S/S	15.75
West Townsend S/S	10.50
Spare	0.00
Total	135.25